Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*					R-1 Program Element (Number/Name) PE 0602236N *I Warfighter Sustainment Applied Res*							
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
Total Program Element	0.000	48.606	65.782	63.825	-	63.825	64.558	66.263	67.788	68.361	Continuing	Continuing
0000: *Warfighter Sustainment Applied Res*	0.000	48.606	58.882	63.825	-	63.825	64.558	66.263	67.788	68.361	Continuing	Continuing
9999: *Congressional Adds*	0.000	0.000	6.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.900

A. Mission Description and Budget Item Justification

This Program Element (PE) supports innovation-based efforts that will provide technology options for future Navy and Marine Corps capabilities. Efforts focus on advanced Naval materials; biocentric technologies; environmental quality; human factors and organizational design; medical technologies; and Naval training technologies. Within the Naval Transformation Roadmap, this investment maps to future transformational capabilities and the FORCEnet pillar of the CNO and the Commandant of the Marine Corps vision for the future -- Naval Power 21.

This PE supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners.

The efforts described in this Program Element PE are based on investment directions as defined in the Naval Research and Development Framework which is developed from Navy and Marine Corps guidance and input from the Naval Research Enterprise (NRE) stakeholders (including the Naval enterprises, the combatant commands, the Chief of Naval Operations (CNO), and Headquarters Marine Corps). It provides the vision and key objectives for the essential science and technology efforts that will enable the continued supremacy of U.S. Naval forces in the 21st century. Strategy focuses and aligns Naval S&T with Naval missions and future capability needs that address the complex challenges presented by both rising peer competitors and irregular/asymmetric warfare.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

Exhibit R-2, RDT&E Budget Item Justification: PB 2020 Navy	Date: March 2019
Appropriation/Budget Activity 1319: *Research, Development, Test & Evaluation, Navy I* BA 2: *Applied Research*	**R-1 Program Element (Number/Name)** PE 0602236N *I Warfighter Sustainment Applied Res*

B. Program Change Summary ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Previous President's Budget	48.649	56.197	56.133	-	56.133
Current President's Budget	48.606	65.782	63.825	-	63.825
Total Adjustments	-0.043	9.585	7.692	-	7.692
• Congressional General Reductions	-	-			
• Congressional Directed Reductions	-	-			
• Congressional Rescissions	-	-			
• Congressional Adds	-	9.585			
• Congressional Directed Transfers	-	-			
• Reprogrammings	1.000	0.000			
• SBIR/STTR Transfer	-1.043	0.000			
• Program Adjustments	0.000	0.000	7.692	-	7.692

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2018	FY 2019
Project: 9999: *Congressional Adds*		
Congressional Add: *Program Increase*	0.000	2.400
Congressional Add: *Warfighter Safety and Performance*	0.000	4.500
Congressional Add Subtotals for Project: 9999	0.000	6.900
Congressional Add Totals for all Projects	0.000	6.900

Change Summary Explanation

The funding increase from FY 2019 to FY 2020 is due to the original PE structure being retained. Warfighter Sustain Applied Research project reflects the realignment of resources from PE: 0603671N (U)Navy Advanced Technology Development(ATD) Proj. 3433 for Human Research Protection Program (HRPP) back into PE: 0602236N Warfighter Sustainment Applied Res Proj: 0000 and into the Human Research Protection Program (HRPP) R2 Activity.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy											Date: March 2019	
Appropriation/Budget Activity 1319 / 2					R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*				Project (Number/Name) 0000 / *Warfighter Sustainment Applied Res*			
COST ($ in Millions)	**Prior Years**	**FY 2018**	**FY 2019**	**FY 2020 Base**	**FY 2020 OCO**	**FY 2020 Total**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**	**Cost To Complete**	**Total Cost**
0000: *Warfighter Sustainment Applied Res*	0.000	48.606	58.882	63.825	-	63.825	64.558	66.263	67.788	68.361	Continuing	Continuing

A. Mission Description and Budget Item Justification

Efforts in this PE focus on; advanced naval materials; biocentric technologies; environmental quality; human factors and organizational design; medical technologies; international science and science advisor programs; and Naval systems training and education.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Title: ADVANCED NAVAL MATERIALS	11.004	11.455	14.715	0.000	14.715
Description: Advanced Naval Materials efforts support several Science and Technology (S&T) Focus Areas, in particular Platform Design & Survivability, and perform research across a broad spectrum of technical areas including: structural materials to increase platform performance and survivability at reduced weight and cost; advanced, high-performance materials for energy systems; corrosion mitigation strategies; high-temperature propulsion systems; and enhanced sonar transducers. ***FY 2019 Plans:*** ADVANCED NAVAL MATERIALS: Conduct research on structural materials to include the following: Nanostructured materials processing, composite development, cellular materials, high temperature materials and alternative hull materials. Conduct applied research related to critical S&T to investigate corrosion control modeling, high strength corrosion resistant compositionally complex alloys, corrosion resistant additive manufactured alloys and acoustic transduction technologies. MATERIALS AND PROCESSES: Development of novel and scalable processing methods to produce mechanically robust high temperature superconductor tapes with minimal AC loss for various naval applications such as transformers, inductors, stators and for pulsed power delivery systems for all electric ships. Conduct design new microfluidic system for direct write additive manufacturing to significantly improve the existing techniques. Design multifunctional material systems for use in new helmet design to mitigate multiple threats. Conduct compositional modifications					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
and processing parameters to optimize material performance that have been demonstrated, leading to current plans for their utilization. ***FY 2020 Base Plans:*** -Conduct research on Agile Manufacturing Integrated Computational Materials Engineering (ICME). This effort will establish a robust collection of predictive capabilities based on quantitative experimentation and characterization at all appropriate length scales to accelerate the development and optimization of new materials, and the design of advanced components while reducing the time required for qualification. Application of these tools will enable greater confidence and utilization of additive manufacturing and other advanced manufacturing technologies. -Conduct ongoing research on materials development and advanced processing technologies for acoustic transduction. - Conduct research on structural materials to include the following: nanostructured materials and coatings processing, composite development, cellular materials, high temperature materials, metals and alloys for structural applications, and alternative hull materials. - Conduct applied research related to critical S&T to investigate corrosion control modeling, high strength corrosion resistant coatings and compositionally complex alloys, and corrosion resistant additive manufactured alloys. -Conduct ongoing research that develops enabling manufacturing technology to scale up and improve affordability of science and technology products. Key tasks for this period include development of affordable fabrication technology for submarine coatings. Materials and Chemistry: Develop novel and scalable processing methods to produce mechanically robust high temperature superconductor tapes with minimal AC loss for various naval applications such as transformers, inductors, stators and for pulsed power delivery systems for all electric ships. Design new microfluidic system for direct write additive manufacturing to significantly improve the existing techniques. Design of multifunctional material systems for use in new helmet design to mitigate multiple threats. Compositional modifications and					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
processing parameters to optimize material performance have been demonstrated leading to current plans for their utilization. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The funding increase from FY 2019 to FY 2020 is due to the Agile Manufacturing Integrated Computational Materials Engineering effort initiating in FY20.					
Title: BIOCENTRIC TECHNOLOGIES ***Description:*** Applied research to provide solutions for Naval needs based upon bio-inspired systems, sensors, robotics, and technologies; synthetic biology to produce high-value materials or to develop sentinel organisms; marine mammal diagnostics to support the Navy's Fleet Marine Mammal Systems; and augmented Warfighter performance. ***FY 2019 Plans:*** NAVAL BIOSCIENCE: Conduct research into the development of innovative naval biosensors, biomaterials, and bioprocess technology. Investigate engineering development and optimization of sea-floor sediment energy harvesting system for sustainable and autonomous powering of underwater sensor networks and AUV's. Conduct research on the development of microbial fuel cells for powering a linear sensor array. Study microbial electrochemical systems for shipboard desalination/ waste-to-energy conversion and the closed-loop microbial fuels cells. Research explosive-sensing plants and microbial electrobiosynthesis of liquid fuels. Continue development of microbial electronic devices. SYNTHETIC BIOLOGY FOR SENSING & ENERGY PRODUCTION: Conduct research on synthetic biology studies of engineered sentinel organisms for environmental surveillance and integration of programmable cellular controllers with robotic devices. LIFE SCIENCE AND BIOENGINEERING:	5.709	5.684	7.596	0.000	7.596

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Conduct marine mammal diagnostics efforts, including immunobioassays for stress and infection detection and efforts to detect, treat, and prevent diseases in dolphins, including diabetes and kidney stones. NEURAL, SENSORY AND BIOMECHANICAL SYSTEMS: Conduct efforts on naval biosensor to detect brain structures and blood vessels through skull bones. Investigate advanced biomimetic sensing and neural control for human-robot interaction to enable effective collaboration of warfighters and autonomous systems. Integrate biomimetic sonar with bioinspired autonomous undersea vehicles (with high-lift propulsors)to achieve closed loop control. Conduct research into bioinspired quiet, and maneuverable self-propelled line array using high-lift propulsors based on animal wing and fin biomechanics and in efforts of bio-inspired massively parallel vision systems. Study the development of brain-based intelligent systems to support high level interaction between warfighters and autonomous systems. Continue studies to develop electrosence and biosonar for Mine Counter Measures (MCM) and Explosive Ordinance Device (EOD) missions. MATERIALS AND CHEMISTRY: Conduct development of novel approaches to rapidly identify antibiotic resistant genes in bacterial pathogens of importance for the entire US military force. Success of this effort will enable our transitional partners, the Naval Medical Research Center and the Naval Medical Research Laboratories, for rapid identification of highly resistant bacterial pathogens. A major success has been demonstrated by utilizing NRL developed microbial resistant determinant assay for its advances to system design. ***FY 2020 Base Plans:*** Bio-Inspired Systems: Applied research in areas of: Control of bio-inspired autonomous vehicles in complex maneuvers; and Integration of biomimetic sonar with bio-inspired underwater vehicles for obstacle detection and avoidance. Human Interaction with Autonomous Systems: Applied research in areas of: Development of brain-based intelligent systems to support collaboration between humans and autonomous systems; and Research on human and robotic teammates. Biocentric Technology: Applied research of Naval biosensors, biomaterials, and bioprocess technologies: Accelerate engineering development and optimization of microbial undersea energy harvesting systems for sustainable and autonomous powering of Naval underwater sensor and communication nodes; Examine					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
feasibility of microbial electrochemical systems for shipboard waste-to-energy conversion (including disabled submarine scenarios); Accelerate research in human microbiome for divers, combat swimmers, and submariners; Applied research of devices incorporating engineered sentinel organisms for environmental monitoring (including the human gut); and Integration of programmable cellular controllers with robotic devices. Bioengineering and Life Sciences: Applied research in the areas of: Sequencing technologies as diagnostic tools for viral pathogens in chemical and environmental samples; Various formulations of polymer mimics of mussel adhesion proteins for underwater applications; Highly-efficient proton exchange membrane fuel cells based on designer catalysts and novel catalyst supports for Naval applications; and Improving the health and welfare of the Navy's marine mammals including development of immunobioassays for stress and infection detection and acoustic analysis of dolphin sounds as an indicator of their well-being; Warfighting Augmentation: Applied research in multi-functional textiles that interact with autonomous life support, neuromuscular control and waste management, biosensors and bio-electronics, and adaptive and integrative protection. Materials and Chemistry: Develop novel approaches to rapidly identify antibiotic resistant genes in bacterial pathogens of importance for the entire US military force. Success of this effort will enable our transitional partners, the Naval Medical Research Center and the Naval Medical Research Laboratories, for rapid identification of highly resistant bacterial pathogens. A major success has been demonstrated by utilizing Naval Research Laboratory (NRL) developed microbial resistant determinant assay for its advances to system design. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The funding increases from FY19 to FY20 reflects Biocentric Technologies R2 Activity focus to reduce scope in decision support/uncertainty analysis for operational environments, and increase scope in providing solutions for Naval needs based upon bio-inspired systems.					
Title: ENVIRONMENTAL QUALITY ***Description:*** Environmental Quality technologies enable sustained world-wide Navy operations in compliance with all local, state, regional, national and international laws, regulations and agreements.	2.574	2.764	2.672	0.000	2.672

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
FY 2019 Plans: - Development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms. - Development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems. - Conduct field evaluation of prototype robotic Hull BUG to identify gaps needed to refine and advance the technology for reduced drag, and significant fuel savings. ***FY 2020 Base Plans:*** - Ongoing development of new, advanced, environmentally benign Anti-Fouling (AF)/Anti-Corrosive (AC) coating systems for Navy platforms. - Ongoing development of advanced environmentally sound technologies for shipboard waste treatment and pollution abatement systems. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no significant change from FY 2019 to FY 2020.					
Title: HUMAN FACTORS AND ORGANIZATIONAL DESIGN ***Description:*** Applied research to improve system interface designs and human-level decision support in Naval contexts. Research areas include human-machine teaming, social networks and computational social science, and command decision making. ***FY 2019 Plans:*** HUMAN COMPUTER INTERACTION/VISUALIZATION: Conduct research on audio-visual cue integration for 360-degree periscope displays by utilizing eye-tracking, sleep studies and traditional behavioral measures to characterize human performance on periscope-related tasks under a variety of physiological conditions.	5.161	5.777	5.745	0.000	5.745

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
COMMAND DECISION MAKING (CDM): Development of task management algorithms applicable to agile supervisory control of teams involving human and autonomous agents. Research the development of an information infrastructure that is operational context sensitive to allow the dynamic prioritization of date based on its anticipated information value and mission criticality. Study building proactive decision support tools for Command and Control. Investigate Navigating in Uncertainty. SOCIAL NETWORK ANALYSIS: Initiate development of warfighting experiments for information environment assessment, civil-military communications (public affairs), information operations and psychological operations. ***FY 2020 Base Plans:*** Human-Machine Teaming: Applied research on system interface designs and human-machine interaction methodologies that enable or enhance Warfighter performance and human-machine teaming. Focus areas include: (i) Physiological monitoring and cognitive state estimation; (ii) Psychoacoustics and audio-visual scene interpretation; and (iii) Rapid interface design evaluation. Social Networks and Computational Social Science: Applied research in information environment assessment, civil-military communications (public affairs) information operation, and psychological operations. This research addresses problems of countering influence operations, dealing with polarized audiences, and mitigation of social hysteria propagation in online and real-world information campaigns. These efforts include gamification to provide principles and foundational frameworks for development of training and exercises, including operating in contested information environments. Command Decision Making: Applied research in decision aid algorithms and human interfaces for command and control processes, to include alerting command staff when mission re-planning is required. Research technologies to capture and share practical knowledge that is learned on the job and effectively share with peers as a supplement to formal training. Conduct applied research for the development of supervised learning algorithms that capture mission planning workflow for a range of missions. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no significant change from FY 2019 to FY 2020.					
Title: MEDICAL TECHNOLOGIES	6.462	5.839	5.771	0.000	5.771

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
Description: Applied research in reducing operational health threats and enhancement of human performance; development of point-of-injury medical equipment, diagnostic capabilities and treatments; technologies to improve Warfighter safety and to enhance personnel performance under adverse conditions. To prevent duplication of effort, research is coordinated with other Services through the Armed Services Biomedical Research Evaluation and Management (ASBREM) Committee. ***FY 2019 Plans:*** UNDERSEA MEDICINE: Conduct efforts to reduce operational injuries. Study Decompression Sickness (DCS) and Arterial Gas Embolism (AGE), to include novel approaches to the prevention, detection and treatment of DCS/AGE, particularly by non-recompressive methods. Investigate the development of prophylactic agents preventing hyperbaric oxygen toxicity. Prolonged exposure to hyperbaric oxygen can be toxic to lungs, nervous system and eyes. Study the optimization of diver and submariner health and performance when exposed to a variety of environmental and unique stressors (heat and cold, prolonged deployments, effects of altered diurnal rhythms, non-standard breathing gases, lack of sunlight, etc). Explore novel pharmaceutical interventions for hyperbaric oxygen toxicity. Continue research on improving performance in extreme environments including integrated diving helmet audio-visual displays; human-machine symbiosis; nutrition, hydration and gut microbiome studies; and genomics/ metabolomic approaches. REGENERATIVE MEDICINE: Continue the program with the Armed Forces Institute for Regenerative Medicine (AFIRM). NOISE INDUCED HEARING LOSS (NIHL): Conduct research to reduce noise at the source, i.e. jet engine quieting and flight deck noise reduction. Study the biomedical effects of underwater sound as military divers must operate safely and effectively in potentially complex underwater sound fields. Mitigate the impact of exposure to stressful combat environments prior to deployment through "stress inoculation". Study the incidence, susceptibility, and mitigation strategies of NIHL and tinnitus. Research the					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
prevention, treatment and reversal of NIHL and tinnitus. Investigate the improvement of personal protective equipment technology. Continue Jet Noise Reduction Project to utilize analytical modeling and simulation tools anchored by experiment to develop and assess solutions enabling mitigation of jet induced noise from high performance tactical aircraft. ***FY 2020 Base Plans:*** Undersea Medicine and Performance: Applied research efforts include: Integrated diving helmet audio-visual displays; and Pharmacological agents and technologies to mitigate decompression sickness and oxygen toxicity. Sensory Neuroscience and Whole-body Physiology: Applied research to improve personal protective equipment and monitoring systems in order to mitigate biomedical effects of exposure to high-levels of acoustic pressure or electromagnetic energy. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no significant change from FY 2019 to FY 2020.					
Title: HUMAN RESEARCH PROTECTION PROGRAM (HRPP)	0.000	2.685	2.705	0.000	2.705
Description: Part 46 of Title 45, Code of Federal Regulations (CFR), Protection of Human Subjects (henceforth: "Common Rule") is codified in the Department of Defense (DoD) as 32 CFR 219, and implemented through DoD Instruction 3216.02, which is the policy that must be followed for human subjects research conducted, supported, or otherwise subject to regulation by any federal department or agency. The Secretary of the Navy Instruction SECNAVINST 3900.39E identifies the Chief of Naval Research (CNR) as providing support and expertise for human research protection in the systems commands, operational forces, training commands and DON-supported non-DoD institutions. The HRPP program satisfies the aforementioned regulations and policies by: 1) ensuring that research involving human subjects complies with Federal, DoD, and DON research protection requirements; and 2) providing education programs in human research ethics to all levels of staff involved in the review, approval, conduct, management, or support of DON research involving human subjects. ***FY 2019 Plans:*** Implement the DON Human Research Protection Program (HRPP) in the Navy's Systems Commands, operational forces, training commands, and DON-supported research involving human subjects performed					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
by non-DoD institutions, and enforce regulatory compliance in human subjects research conducted and supported by the DON. Specific tasks include: DON-wide training for the revised Common Rule at 45 Code of Federal Regulations Part 46 Subpart A, develop new Human Research Protection Programs for 3 non-medical commands, and create non-medical DON human research protection community of excellence network ***FY 2020 Base Plans:*** Execute DON HRPP Management Plan; provide day-to-day oversight of DON HRPP activities; conduct periodic site inspections and assist visits; conduct training for Exempt Determination Officials, conduct Component and Headquarters-level review of DON-supported human subjects research; provide subject matter expertise and guidance on all DON-supported research involving human subjects; implement revisions to Standard Operating Procedures in light of revisions to the Common Rule and SECNAVINST 3900.39E; and provide DON input to USD(R&E) and other DoD policy guidance impacting DON human research-related efforts. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** The funding increase from FY 2019 to FY 2020 reflects the realignment of resources from PE: 0603671N (U)Navy Advanced Technology Development(ATD) Proj. 3433 for Human Research Protection Program (HRPP) back into PE: 0602236N Warfighter Sustainment Applied Res Proj: 0000 and into the Human Research Protection Program (HRPP) R2 Activity.					
Title: THE OFFICE OF NAVAL RESEARCH GLOBAL ***Description:*** Supports the Office of Naval Research (ONR) Global mission to serve as the preeminent external facilitator for the Naval Research Enterprise. This is accomplished by establishing quality, relevant connections between the international research and development community, Naval fleet/forces, DOD, other US Government agencies and international partners. Science Advisors (SA): This effort ensures that the operational Naval fleet/force help shape the DON investment in science and technology (S&T), develops teaming relationships to rapidly prototype, experiment, demonstrate and transition technology, supports development of technology-based capability options for Naval forces, and enables warfighting innovations based on technical and conceptual possibilities. The SA Program also informs capability-based war games using current and future technology to identify future capability strengths and shortfalls that assist in shaping the DON investment strategy. The ONR Global SA Program enables continuous	12.737	19.760	19.733	0.000	19.733

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
communication and collaboration between the warfighters, the Naval Research & Development Enterprise, and strategic development commands. INTERNATIONAL SCIENCE: The ONR Global mission is also accomplished through PhD-level scientists located in Asia, Europe and South America, providing coverage in these regions as well as Africa, Australia/ New Zealand and the Middle East. ONR Global scientists actively search the globe for emerging scientific research and promising technologies, collaborating with international organizations and researchers through liaison visits and grants in innovative applied research. The direct impact of this investment is to leverage international research during increasingly dynamic global interdependence and improve the ability to solve DON S&T challenges through shared knowledge and technologies with partners. In addition, this investment builds global S&T awareness to reduce the risk of potential technological surprise, and supports theater security cooperation goals to sustain cooperative relationships with an expanding set of international partners. INTERNATIONAL ENGAGEMENT: ONR Global also supports international engagement with partner nations through the development and maintenance of bilateral and multilateral relationships, international agreements, and other activities that promote RDT&E collaboration and interoperability. ***FY 2019 Plans:*** ONR Global will support 28 PhD level scientists, in seven overseas offices, continuing to engage with international scientists and engineers through liaison visits to research institutions and continue actively fostering international collaboration by awarding research grants. ***FY 2020 Base Plans:*** - Support all Science Advisor program efforts across Fleet and Forces Commands; objectively assess placement of current Science Advisors and requests for additional support in terms of impact to the Fleet and S&T return on investment. -Support PhD-level scientists, in seven overseas offices, continuing to engage with international scientists and engineers through liaison visits to research institutions and continue actively fostering international collaboration by awarding research grants.					

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
- Support international engagement with ten partner nations, three multi-lateral groups, and support to the Northern Atlantic Treaty Organization (NATO), in order to increase collective Naval capability, capacity, and interoperability. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:*** There is no significant change from FY 2019 to FY 2020.					
Title: TRAINING TECHNOLOGIES ***Description:*** Applied research to enhance the Navy's ability to "train as they fight" in classroom settings, simulated environments, and during deployment to operate effectively in complex, high stress, information-rich, and ambiguous environments of modern warfare. Improved efficiency and cost-effectiveness is achieved by applying operations research, modeling and simulation, and instructional, cognitive, and computer sciences to the development, delivery, evaluation, and execution of training and education. To prevent duplication of effort, research is coordinated with other Services via the Human Systems Community of Interest. ***FY 2019 Plans:*** COGNITIVE SCIENCE OF LEARNING: Conduct research and associated efforts to assess advanced gaming technology for enhanced training. Conduct experiments to validate automated performance assessment and after action reviews. Development a systematic program of applied research addressing unanswered questions regarding effective instructional strategies in artificially intelligent tutoring. Conduct research the neurobiology of learning including integration of the role of white matter. Develop games that incorporate Artificial Intelligence (AI) techniques to teach complex warfighter skills decision-making and problem solving. Continue work to develop optimal training strategies for intelligent jobs on mobile devices (e.g., IPad) and immersive environments for training interpersonal and leadership skills. Work to design and conduct experiment to assess training effectiveness of intelligent tutor for training ship handling skills. Efforts to design features and develop novel psychometric approaches to assess human performance in medical/military simulations and simulators. Conduct field studies and user tests evaluating new features and job aiding tools. Continue research in computational neuron-models in the design of training systems. Conduct ongoing efforts to develop skill decay models for psychomotor, perceptual, and cognitive skills and refresher training strategies. Work to create intelligent avatars to interact with learners from different cultural, linguistic backgrounds, and preferences. Continue design scenarios generators that produce	4.959	4.918	4.888	0.000	4.888

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Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
integrated (e.g.,individual and collective) training. Development of computational model for learning theory to drive design of instruction and continue research on individual differences. ENHANCING WARFIGHTER COGNITIVE CAPABILITY: Conduct research to understand the structural relations among the latent variables of short-term memory, working memory, executive attentional control, and fluid intelligence. Work to assess the improvement in recruit classification provided by the addition of measures of fluid intelligence and working memory. Efforts to understand the role of intrinsic motivation in facilitating the transfer of working memory training to other cognitive capabilities. Continue the study the efficacy of game-based brain training using hand-held (fieldable) hardware platforms. Conduct work to determine the relationship between induced gains in fluid intelligence and cognitive adaptability and agility, considered from the perspective of military decision-making. Develop multi-agent based architectures for modeling human behavior, improve techniques for human cognitive and behavioral modeling, and create highly realistic simulated teammates. COMPUTATIONAL MODELS OF HUMAN BEHAVIOR: Research game based training to more effectively enable better warfighter understanding of languages and cultures to enhance their regional expertise. Development of software tools to facilitate building natural language tutorial dialogs for artificially intelligent tutoring. Continue integration of cognitive and neuron-computational models of human learning. ***FY 2020 Base Plans:*** Technologies for Naval Training: Applied research to augment training, skill maintenance, and evaluation through gaming, and learning theory. Research includes developing effective instructional strategies in intelligent tutors and conducting evaluation of intelligent job aids. Develop computational models of skill decay for psychomotor, perceptual, and cognitive skills, and refresher training strategies. Advanced Integrated Maritime Mission Modeling: Applied research in the development of live, virtual, and constructive training and experimentation technologies. Efforts will include developing tools for training in denied and degraded electromagnetic environments and in extreme weather environments. ***FY 2020 OCO Plans:*** N/A ***FY 2019 to FY 2020 Increase/Decrease Statement:***					

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy		Date: March 2019
Appropriation/Budget Activity 1319 / 2	**R-1 Program Element (Number/Name)** PE 0602236N / *Warfighter Sustainment Applied Res*	**Project (Number/Name)** 0000 / *Warfighter Sustainment Applied Res*

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total
There is no significant change from FY 2019 to FY 2020.					
Accomplishments/Planned Programs Subtotals	48.606	58.882	63.825	0.000	63.825

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

As discussed in Section A, there are a significant number of varied efforts within this PE. Each effort is measured against both technical and financial milestones. Each program effort and its projects are reviewed in depth for technical and transition performance against established goals. The Program Managers conduct routine site visits to performing organizations to assess programmatic and technical progress and most projects conduct an annual or biannual review by an independent board of visitors who assess the level and quality of the Science and Technology (S&T) basis for the project.

Exhibit R-2A, RDT&E Project Justification: PB 2020 Navy			Date: March 2019
Appropriation/Budget Activity 1319 / 2	R-1 Program Element (Number/Name) PE 0602236N / *Warfighter Sustainment Applied Res*	Project (Number/Name) 9999 / *Congressional Adds*	

COST ($ in Millions)	Prior Years	FY 2018	FY 2019	FY 2020 Base	FY 2020 OCO	FY 2020 Total	FY 2021	FY 2022	FY 2023	FY 2024	Cost To Complete	Total Cost
9999: *Congressional Adds*	0.000	0.000	6.900	0.000	-	0.000	0.000	0.000	0.000	0.000	0.000	6.900

A. Mission Description and Budget Item Justification

Congressional Interest Items not included in other Projects.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2018	FY 2019
Congressional Add: Program Increase ***FY 2018 Accomplishments:*** N/A ***FY 2019 Plans:*** Research into social networks and the impact of novel technologies on human behavior in crisis and collaborative contexts.	0.000	2.400
Congressional Add: Warfighter Safety and Performance ***FY 2018 Accomplishments:*** N/A ***FY 2019 Plans:*** Conduct research to include: continued studies on decompression sickness, oxygen toxicity, optimization of diver performance, and assessment of the impact of thermal stress on operational performance.	0.000	4.500
Congressional Adds Subtotals	0.000	6.900

C. Other Program Funding Summary ($ in Millions)

N/A

Remarks

D. Acquisition Strategy

N/A

E. Performance Metrics

Congressional Interest Items not included in other Projects.